3D DISLOCATION DYNAMICS SIMULATION OF DISLOCATION AND PRECIPITATE INTERCATION: CASE OF SPHERICAL AND CUBICAL, SHEARABLE AND NON-PENETRABLE PARTICLES.

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In the aim of better understanding the effect of precipitates on hardening and on strain localization, a discrete dislocation dynamics code is used and adapted. The image force on a dislocation line near a spherical and cubical particle is obtained from the 3D boundary value problem within the linear theory of elasticity using a FEM-DDD coupling code. In a previous study [1], the effect of the difference of elastic modulus between the matrix and a non penetrable particle was analyzed focusing on the yield stress and the induced hardening.

In this presentation, the effects of the particle shape and the dislocation type on the image force are examined in details. It is found that the image force by a cubical particle is higher than that of a spherical particle of the same volume by 20% and the cubical particle is more resistant to the climb of a dislocation. The influence of the image stresses on the flow stress and hardening is investigated in the case of materials containing impenetrable particles. Dislocation cross slip is observed when a certain number of Orowan loops is reached. Finally, a method is developed to simulate the case of shearable particles in 3D. Applications of this tool are presented with special a emphasis on strain localisations.

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